PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference P928PC00	**FOR FURTHER ACTION**	See Form PCT/IPEA/416
International application No. PCT/DK2005/000230	International filing date *(day/month/year)* 05.04.2005	Priority date *(day/month/year)* 05.04.2004
International Patent Classification (IPC) or national classification and IPC INV. G01S13/58 G01S7/35		
Applicant WEIBEL SCIENTIFIC A/S ET AL.		

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 8 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
   a. ☒ *sent to the applicant and to the International Bureau)* a total of 11 sheets, as follows:
      ☒ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
      ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
   b. ☐ *(sent to the International Bureau only)* a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in celectronic form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

☒	Box No. I	Basis of the report
☐	Box No. II	Priority
☐	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
☐	Box No. IV	Lack of unity of invention
☒	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
☐	Box No. VI	Certain documents cited
☐	Box No. VII	Certain defects in the international application
☒	Box No. VIII	Certain observations on the international application

Date of submission of the demand	Date of completion of this report
06.02.2006	26.04.2006
Name and mailing address of the international preliminary examining authority: European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016	Authorized officer Roost, J Telephone No. +31 70 340-4423

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/DK2005/000230

Box No. I Basis of the report

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

   ☐ This report is based on translations from the original language into the following language , which is the language of a translation furnished for the purposes of:
   - ☐ international search (under Rules 12.3 and 23.1(b))
   - ☐ publication of the international application (under Rule 12.4)
   - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)

2. With regard to the **elements*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

Description, Pages

1-40	as originally filed

Claims, Numbers

1-36	received on 08.02.2006 with letter of 06.02.2006

Drawings, Sheets

1/11-11/11	as originally filed

☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing

3. ☐ The amendments have resulted in the cancellation of:
   - ☐ the description, pages
   - ☐ the claims, Nos.
   - ☐ the drawings, sheets/figs
   - ☐ the sequence listing *(specify)*:
   - ☐ any table(s) related to sequence listing *(specify)*:

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
   - ☐ the description, pages
   - ☐ the claims, Nos.
   - ☐ the drawings, sheets/figs
   - ☐ the sequence listing *(specify)*:
   - ☐ any table(s) related to sequence listing *(specify)*:

* *If item 4 applies, some or all of these sheets may be marked "superseded."*

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-36
	No:	Claims	
Inventive step (IS)	Yes:	Claims	6,8-10,13-23,25,26,28-36
	No:	Claims	1-5,7,11,12,24,27
Industrial applicability (IA)	Yes:	Claims	1-36
	No:	Claims	

2. Citations and explanations (Rule 70.7):

see separate sheet

Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

Re Item VIII

Certain observations on the international application

1 The application does not meet the requirements of Article 6 PCT, because claims 1, 9, 13 and 22 are not clear.

1.1 Although claims 1, 9, 13 and 22 have been drafted as separate independent claims, they appear to relate effectively to the same subject-matter and to differ from each other only with regard to the definition of the subject-matter for which protection is sought. The aforementioned claims therefore lack conciseness and as such do not meet the requirements of Article 6 PCT.

1.2 In particular, **independent claims 13 and 22** appear to contain **all** the features of independent claim 1, and as such could easily have been formulated as being dependent on claim 1.

1.3 It is clear from the description on page 4, line 29 - page 5, line 12, that the following feature is essential to the definition of the invention:

> at least two receivers are arranged along a first receiver direction and at least two receivers are arranged along a second receiver direction, said first receiver direction being different to the second receiver direction.

Since **independent claim 9** does not contain this feature it does not meet the requirement following from Article 6 PCT taken in combination with Rule 6.3(b) PCT that any independent claim must contain all the technical features essential to the definition of the invention.

It is furthermore noted that claim 9, when including this feature, could easily have been formulated as being dependent on claim 1.

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

2 The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of claims 1-5, 7, 11, 12, 24, 27 does not involve an inventive step in the sense of Article 33(3) PCT.

2.1 Independent claim 1

Document D1, which is considered to represent the most relevant state of the art to the subject matter of claim 1, discloses (see D1: the whole document):

A radar system for detection of one or more objects, said system comprising:
a radar wave transmitter for simultaneously transmitting a CW radar signal and a FM-CW radar signal,
a first radar wave receiver for receiving CW and FM-CW radar signals reflected from one or more objects present in a detection range of the radar system,
a first CW mixer for mixing CW transmission signals and reflected CW signals received by the first receiver to produce one or more first CW beat signals, each first CW beat signal relating to the velocity of an object, and
a first FM-CW mixer for mixing FM-CW transmission signals and reflected FM-CW signals received by the first receiver to produce one or more first FM-CW beat signals, each first FM-CW beat signal relating to the distance to and the velocity of an object.

The subject-matter of independent claim 1 differs from the disclosure of D1 in that:

second and third radar wave receivers with corresponding second and third CW mixers and FM/CW mixers are present, and
at least two receivers are arranged along a first receiver direction and at least two receivers are arranged along a second, different receiver direction

The problem to be solved by the present invention may therefore be regarded as determining target angle in two directions

The solution proposed in claim 1 of the present application cannot be considered as involving an inventive step (Article 33(3) PCT) for the following reasons.

Document D4 discloses a CW radar system with three receivers arranged in two directions, to determine, from phase differences between the identical receiver

channels, target angle in two directions.
It would be obvious to the person skilled in the art, namely when the same result is to be achieved, to apply these features with corresponding effect to a radar system according to document D1. It would in that case also be obvious to implement the receiver channel layout of D1 to all the channels, thereby arriving at the radar system according to claim 1.

2.2 Dependent claims

Dependent claims 2-5, 7, 11, 12, 24, 27 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of novelty and/or inventive step, the reasons being as follows:
w.r.t. claims 2-5, 7, 11, 12:
D4 also discloses determining target angle in two substantially perpendicular directions from phase differences between Fourier transformed outputs of the different receiver channels
w.r.t. claim 24:
D1 discloses the use of a "sawtooth" FM-CW signal, i.e. containing a frequency ramp
w.r.t. claim 27:
both D1 and D4 disclose the object velocity being determined on at least part of the produced CW beat signals

3 Independent claims 9, 13, 22

3.1 Furthermore, the above-mentioned (see **Re Item VIII**) lack of clarity notwithstanding, the subject-matter of independent claims 9, 13 and 22 includes all the features of independent claim 1, and in addition the following:
claim 9:

for each CW mixer there is corresponding transforming means for taking the Fourier transform of the beat signal(s) from said CW mixer, and the radar system further comprises means for summing the Fourier transformed outputs corresponding to each of said CW mixer and for determining a number of CW peak frequencies from the summed Fourier transformed CW signals, and/or wherein
for each FM-CW mixer there is corresponding transforming means for taking the

Fourier transform of the beat signal(s) from said FM-CW mixer, and the radar system further comprises means for summing the Fourier transformed outputs corresponding ta each cf said FM-CW mixer and for determining a number of FM-CW peak frequencies from the summed Fourier transformed FM-CW signals.

claim 13:

for each CW mixer there is corresponding transforming means for taking the Fourier transform of the beat signal(s) from said CW mixer, and
for each FM-CW mixer there is corresponding transforming means for taking the Fourier transform of the beat signai(s) from said FM-CW mixer, and wherein said radar system further comprising phase detecting means for detecting phase differences between corresponding refiected CW or FM-CW radar signals, wherein
the phase detecting means are adapted to determine a first phase difference between corresponding reflected CW or FM-CW radar signals received by said at least two radar wave receivers arranged along the first receiver direction, said first phase difference relating to a first object angular direction, and
the phase detecting means are adapted to determine a second phase difference between corresponding reflected CW or FM-CW radar signals received by said at least two radar wave receivers arranged along the second receiver direction, said second phase difference relating to a second object angular direction,
said radar system further comprising means for establishing and maintaining one or more CW track records corresponding to one or more objects, each track record comprising a number of detected CW peak frequencies as a function of time and further holding information of first and second angular directions as a function of time determined from measurements of corresponding first and second phase differences, and/or
said radar system further comprising means for establishing and maintaining one or more FM-CW track records corresponding to one or more objects, each track record comprising a number of detected FM-CW peak frequencies as a function of time and further holding information of first and second angular directions as a function of time determined from measurements of

corresponding first and second phase differences.

claim 22:

a fourth radar wave receiver with corresponding CW and FM-CW mixers the first and second receivers are arranged horizontally besides each other, the third and fourth receivers are arranged horizontally besides each other, with the third and fourth receivers being arranged vertically below the first and second receivers, respectively, and wherein
for each CW mixer there is corresponding transforming means for taking the Fourier transform of the beat signal(s) from said CW mixer, and
for each FM-CW mixer there is corresponding transforming means for taking the Fourier transform of the beat signal(s) from said FM-CW mixer,
said radar system further comprising phase detecting means for detecting phase differences between corresponding reflected CW or FM-CW radar signals,
wherein the phase detecting means are adapted to determine an azimuth phase difference between the sum of the two Fourier transformed outputs corresponding to the first and third receivers and the sum of the two Fourier transformed outputs corresponding to the second and fourth receivers, and/or
wherein the phase detecting means are adapted to determine an elevation phase difference between the sum of the two Fourier transformed outputs corresponding to the first and second receivers and the sum of the two Fourier transformed outputs corresponding to the third and fourth receivers.

As these three independent claims have features that go beyond those of document D1, which is considered to represent the most relevant state of the art, and also beyond the combination of D1 and D4 or any of the other disclosed prior art documents, the subject-matter of these claims is therefore new (Article 33(2) PCT) and is also considered as involving an inventive step (Article 33(3) PCT).

3.2 Claims 10, 14-21, 23, 25, 26, 28-36 are dependent on claims 9, 13 or 22 and as such also meet the requirements of the PCT with respect to novelty and inventive step.